

104. Discharge tube for impulse voltages up to 2 700 000 V. A. SINGERMAN, M. KORSUNSKII, M. NEKRASOV AND A. EISENBET. J. Techn. Phys. U.S.S.R., 9, 10, pp. 883-889, 1939. In Russian. — Using Lange and Brasch's idea of erecting a tube of discs the authors employed discs of micalex and steel alternately. By pasting the discs together with an insulating varnish it becomes possible to erect a monolithic tube of sufficiently good electric and vacuum-sealing qualities. It was shown that the sparking distance in air of a valve designed for a certain impulse voltage depends on the form of the electrodes. These latter being of a suitable size the length of the tube is only determined by the breakdown strength of the air. Thus a tube with 2 m. between electrodes of the Rogowski type will stand an impulse voltage of 2 700 000 V if there is no gas discharge within the tube. A gas discharge spoils the potential distribution in the tube and causes surface leakages covering portions comprising several elements of the tube. F.B.K.

Discharge in tubes in a high vacuum at impulse voltages up to 2.5 million volts. I. A. S. Zingerman and M. I. Kozumskii. *J. Tech. Phys.* (U. S. S. R.) 9, 1345-50 (1939). Cathodic oscillograms show that the lag of discharge behind the voltage diminishes when the voltage (50-2500 kv.), the gas pressure (10^{-4} to 10^{-1} mm. Hg.), and the length of the tube (40-500 cm.) increase. II. A. S. Zingerman. *J. Tech. Phys.* (U. S. S. R.) 9, 1351-53 (1939). At a given voltage the ionization of the gas begins when the product of gas pressure by length of tube has a const. value. The breakdown consists of several stages lasting 10^{-4} to 10^{-1} sec. The resistance of the tube decreases from 10^8 ohms at the start to 100 ohms at the end of the discharge. The yield of electrons increases with voltage. The state and material of the cathode affect the ionization but are without influence on the breakdown. J. F. Bickerman

ASB-SL-A METALLURGICAL LITERATURE CLASSIFICATION

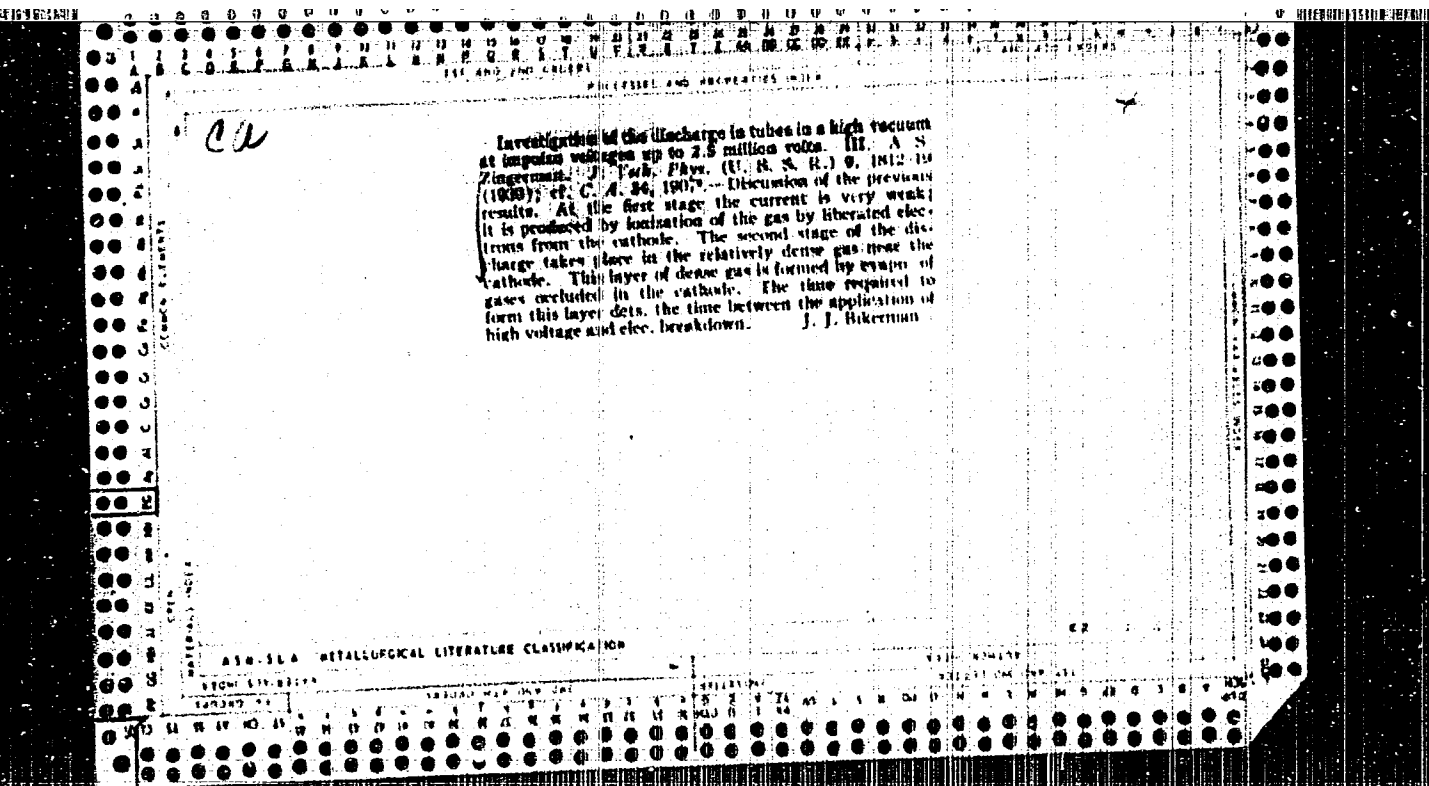
REGION: 11-11-11-11

SECTION: 11-11-11-11

SECTION: 11-11-11-11

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SECTION: 11-11-11-11



General V. K. ...

415

537.54 400
On the Mechanism of the Progress of a Discharge.
—A. Zingerman & N. N. Nefedovskaya. (Zh. eksp.
teor. fiz., 1968, Vol. 16, No. 6, pp. 499-502. In
Russian.) Photographs were taken of incomplete
discharges between two spheres separated by dis-
tances of several hundred millimeters. Impulse
voltages up to 5 kV were applied to the spheres.
It appears from these photographs that the dis-
charge channel is not formed by the movement from
the cathode to the anode of a single electron
avalanche but consists of several merging streams.
The speed of the growth of the electron avalanche
is discussed and two typical photographs are shown.

CA

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Effect of an irradiation of the discharge gap by electrons and rays on the breakdown voltage and the nature of the discharge. M. A. Bak, A. S. Zingerman, and N. N. Nikolaevskaya (Leningrad. Politekh. inst.). *Zhur. Tekh. Fiz.* 17, 689-98 (1947).--For short discharge gaps (up to 10 cm.) the source of electrons and γ -rays was a tube previously described (Zingerman and Korsunskii, *C.A.* 34, 19077) and operating at voltages up to 3000 kv. supplied by an impulse generator. The 2 electrodes (2 spheres of 125 mm. diameter or 1 sphere) and a Cu mesh were placed axially in the beam or perpendicular to it at distances of 25 or 167 cm. from the Al foil window of the tube. The rectified voltage on the gap could reach 100 kv. The breakdown voltage was considered to be the voltage corresponding to 50% occurrence of discharge. The error was approx. 5%. For long discharge gaps another tube was used which is also described in the above paper and consists of hollow porcelain insulators. The exit window of the tube served as 1 electrode, the other being suspended above it at distances up to 100 cm. The same impulse generator delivered voltage to tube (up to 700 kv.) and to the gap (\sim 600 kv.). The exptl. results

show that on plotting the drop of voltage due to irradiation ($\Delta U/U_0$)% versus the length of the gap, there is a min. at 2.5 cm. By inserting a paraffin block in the path of the rays it can be shown that γ -rays have only a slight influence (4-7%) as compared to electrons + γ -rays (30-45%). When the axis of the electron beam corresponds to the axis of discharge there is an action on the gap only if the neg. electrode is turned towards the tube. Study of long gaps gives qual. data to explain these results. It could be shown that the topography of the field was of prime importance; if the discharge started at the anode, irradiation furthered it; if it started at the cathode, irradiation quenched it. This is attributed to a space-charge formation at the neg. electrode. S. Pakover

117 AND 120 GROUP PROCESS AND PROPERTIES INDEX

31

B

*1665. Investigation of the Time Lag of Spark Discharge at Long Gaps. (In Russian.) M. A. Bek, A. S. Zingerman, and N. H. Nikolaevskaya. *Journal of Technical Physics* (U.S.S.R.), v. 17, June 1947, p. 669-680.

An analysis of the physical processes occurring in a long-gap spark discharge at pressures approaching atmospheric. The theory was verified by experimental data obtained from 6000 oscillograms.

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ASR-514 METALLURGICAL LITERATURE CLASSIFICATION

RECORDS HAS ONLY SEE

DISASTIONS

JA AT A S B 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

RECORDS HAS ONLY SEE

DISASTIONS

JA AT A S B 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

<p>117</p> <p>Investigation of the Delay of Spark Discharge in Large Gaps. II. (in Russian.) M. A. Bak, A. S. Zhigermann, and N. N. Nikolaevskaya. Zhurnal Tekhnicheskoi Fiziki (Journal of Technical Physics), v. 17, Oct. 1947, p. 1187-1188.</p> <p>Gives results of a theoretical and experimental investigation of the effects of different factors on the above phenomenon. An equation for calculation of the delay is derived and curves for the relationships of the factors are presented.</p>		<p>38</p>
<p>ASB-51A METALLURGICAL LITERATURE CLASSIFICATION</p>		<p>RESEARCH CENTER</p>
<p>SEARCHED INDEXED</p>		<p>RESEARCH CENTER</p>
<p>117</p>		<p>RESEARCH CENTER</p>

ZINGERMAN, A. S.

Zingerman, A. S. "The development of volt-second characteristics by the method of oblique waves," Trudy Leningr. politakhn. in-ta im. Kalinina, 1948 No. 3, p. 115-20, - Bibliog: 5 items.

SO: U-3736, 21 May 53, (Letopis 'Zhurnal 'nykh Statey, No. 18, 1949).

ZINGERMAN, A. S.

Zingerman, A. S. "The volt-second characteristics of core gaps," Trudy Leningr. politekhn, in-ta im. Kalinina, 1948, No. 3, p. 121-25.

SO: U-3736, 21 May 53, (Letopis 'Zhurnal 'nykh Statey, No. 18, 1949).

ZINGERMAN, A. S.

Zingerman, A. S., Kozyrev, N. A., and Shishman, D. V. "An investigation of the
impulse stability of the insulation of rotary electrical machines,"
Trudy Leningr. politekhn. in-ta im. Kalinina, 1948, No. 3, p. 126-40.

SO: U-3736, 21 May 53, (Letopis 'Zhurnal 'rykh Statey, no. 10, 1949).

ZINGERMAN, A. S.

Zingerman, A. S. "The degree of reliability of protection in voltage overloading,"
Trudy Leningr. politekhn. in-ta im. Kalinina, 1948, No. 3, p. 169-72,
Bibliog: 5 items.

SO: U-3736, 21 May 53, (Letopis 'Zhurnal 'nykh Statey, no. 18, 1949).

13

Statistical Method of Determination of Breakdown Voltage of Dielectrics. (In Russian.) A. S. Zingerman. Zhurnal Tekhnicheskoi Fiziki (Journal of Technical Physics), v. 18, Aug. 1948, p. 1029-1043.

Presents a method for the above and the theory upon which it is based. Proposed equations are graphically interpreted. 17 ref.

117 AND 118 EFFECT										119 AND 120 EFFECT									
PROCESSING AND PROPERTIES INDEX																			
SA										B C 4									
<p>3224. Investigation of the impulse strength of insulation in electrical machinery. ZILBERMAN, A. M. AND ZILBERMAN, A. R. <i>Elektrotekhnika</i> (Moscow), 3: 15-18 (Feb., 1969) in Russian. Tests were made on a number of representative samples and the results subjected to statistical analysis. It was found that the impulse breakdown voltage displayed a wide dispersion, indicating that the average standard of impulse strength could be considerably raised by greater care in manufacturing processes. At room temperatures the impulse coefficient (ratio of impulse breakdown voltage to that at 50 c/s) was a little > 1 for sloping waves (17 kV/μs) but was about 1.5% higher for steep waves (10⁷ kV/μs). The coefficient was considerably greater at the working temperature of 115°C. A continuation of the tests is considered desirable, using a large number of specimens to study the relationship of breakdown voltage to the number of repetitions of the impulse and also to investigate the effect of aging of the insulation on its breakdown strength. A. H.</p>																			
<p>Polytech Inst. in Kalinin, Semizor</p>																			
<p>438-31.4 METALLURGICAL LITERATURE CLASSIFICATION</p>																			

USSR/Physics - Air Rupture Corona	11 Sep 49
Study of Air Rupture in Corona Gaps at Low Voltages, M. A. Bak, A. S. Zingerman, N. N. Nikolayevskaya, Leningrad Polytech Inst. ment M. I. Kalinin, 4 pp	
"Doc Ak Mark GSR" Vol LXVIII, No 2	
Measured currents in the arc gap using shunts and a cathode-ray oscillograph. Discovered appearance of separate current pulses long before complete rupture, amplitude of pulses varying 10-100 ma with a duration of approx one microsecond at intervals of several tens and hundreds of μ s.	
YDD	3/50186
USSR/Physics - Air Rupture (Contd)	11 Sep 49
Microsecond, pulses depend on a number of factors: voltage, gap length, and polarity. Amount of voltage applied to gap has strongest influence on pulses. With increase in voltage: (1) Amplitude of pulses increases sharply. e.g. from 12 ma at 107 kv to 70 ma at 118 kv. (2) Number of pulses decreases. (3) Interval between pulses decreases. Submitted by Acad P. I. Lukirsky 11 Sep 49.	
	3/50186

PA 171115

USSR/Electricity - Testing
Voltage Breakdown

Mar 50

"Determination of Breakdown Voltage From Specimen Tests," A. S. Zingerman, Cand Tech Sci, Leningrad Polytechnic Inst imeni Kalinin.

"Elektrichestvo" No 3, pp 47-50

Method for subject determination does not require complex calculations. Instructions on how to select necessary number of experiments. Submitted 28 Jun 49.

171115

ZINGERMAN, A. S.

2187100

USSR/Physics - Dielectrics (Contd) Apr 52
electrostatic ionization; quantum-mech theory of
thermal ionization; quantum-mech theory of collision
ionization; thermal rupture.

2187100

Discusses the history of dielec theory, A. F. Ioffe's
theory of collision ionization; the ionization theory
of A. A. Smurov, A. A. Vorob'yev and Ye. K. Zavadov-
skaya; A. Hippel's theory of ionization by slow elec-
trons; H. Frohlich's theory of ionization by fast
electrons; cond mechanism of solids from the stand
point of quantum mechanics; quantum-mech theory of

"Uspehi Fiz Nauk" Vol XLVI, No 4, pp 450-507

"Mechanism and Theory of Rupture of Solid Dielec-
trics," A. S. Zingerman

USSR/Physics - Dielectrics Apr 52

ZINGHERMAN, A.S.

Resistance of an impulse arc. Trudy LIXI no.3:1-7 '55. (MLBA 9:8)

1. Kafedra obshchey elektrotekhniki.
(Electric arc)

ZINGERMAN, A.S.

Category : USSR/Electronics - Gas discharge and Gas-discharge Instruments H-7

Abs Jour : Ref Zhur - Fizika, No 2, 1957, No 4315

Author : Zingerman, A.S.

Title : The Role of the Lentz-Joule Heat in Electric Erosion of Metals

Orig Pub : Zh. tekhn. fiziki, 1955, 25, No 11, 1931-1943

Abstract : The fact that the literature contains two approaches to an explanation of the thermal nature of electric erosion makes it necessary to investigate the phenomenon further. Assuming that the cross section of the discharge channel equals the area of the erosion spot on the electrode, the author calculates the Lentz-Joule heat and compares it with the experimental values, finding that this heat does not play any role at all in the erosion in the case of pulses with durations of 10^{-4} seconds and above. To determine the stage of the discharge in which the Lentz-Joule heat can be noticeable, the author uses the gas-dynamic theory of the broadening of the discharge channel. The applicability of this theory is first tested for small discharge gaps (on the order of 1 micron). One obtains as a result that the Lentz-Joule heat can lead to erosion at brief current pulses with

Card. : 1/2

Category : USSR/Electronics - Gas Discharge and Gas-discharge Instruments H-7

Abs Jour : Ref Zhur - Fizika, No 2, 1957, No 4315

a large electric resistance at the beginning of the process (4% in time). The volume of the eroded metal amounts to approximately 1 -- 2% of the total erosion produced with a single discharge. It is indicated that the experimental data obtained by the author are in good agreement with the approximate calculations of B.N. Zolotyykh, based on the phenomenon of the propagation of heat by heat conductance from the discharge channel into the volume of the electrode metal. Bibliography, 15 titles.

Card : 2/2

ZINGERMAN, A.S.

Name: ZINGERMAN, A. S.

Dissertation: An investigation of the electric breakdown of metals

Degree: Doc Tech Sci

Defended at:

Affiliation: Min Higher Education USSR, Leningrad Polytechnical Inst
imeni M. I. Kalinin

Publication

~~Defense Date~~, Place: 1956, Leningrad

Source: Knizhnaya Letopis', No 4, 1957

~~ZINGERMAN, A. S.~~

Electric erosion in connection with the contact of stationary
electrodes. Trudy LIKI no.4:51-56 '56. (MIRA 10:5)

1. Kafedra obshchey elektrotekhniki.
(Electric spark) (Electrodes)

ZINGERMAN, A. S.

Category : USSR/Electronics - Gas Discharge and Gas-Discharge Instruments

H-7

Abs Jour : Ref Zhur - Fizika, No 1, 1957, No 1719

Author : Zingerman, A.S.

Title : On the Broadening of the Discharge Canal.

Orig Pub : Zh. tekhn. fiziki, 1956, 26, No 4, 1015-1020

Abstract : Results are given of an experimental investigation of the dependence of the diameter of the discharge canal on the energy produced in the canal, for the case of a very small discharge gaps (1 -- 10 microns), such as are encountered in electro-erosion metal working. The diameter of the discharge canal is determined by measuring the erosion crater on the surface of the electrode. The value of the energy was calculated from the current and voltage oscillograms. The duration of the voltage pulse applied to the discharge gap varied from 3.7×10^{-5} to 3×10^{-3} seconds. The energy ranged from 0.1 to 400 joules. It was established that the canal broadens during the entire discharge time, even in the case of prolonged longer discharges. The results of the investigation confirm the hydrodynamic theory of the broadening of the discharge canal, proposed by S.I. Drabkina (Zh. Eksperim i. teor fiziki, 1951, 21, 473). If much energy is liberated in the discharge canal, the electrodes become pulverized and evaporate, and consequently the coefficients contained in S.I. Drabkina's equations, will depend on the material of the electrodes. Bibliography, 10 titles.

Card : 1/1

SINGERMAN, A. S.

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1497
 AUTHOR SINGERMAN, A. S.
 TITLE The Influence exercised by the Passage of Heat on the Electric Erosion of Metals.
 PERIODICAL Zhurn. techn. fis, 26, fasc. 9, 2008-2020 (1956)
 Issued: 10 / 1956 reviewed: 10 / 1956

It was the aim of the present work to determine the temperature distribution in a homogeneous body of infinite measurements which was heated by a surface heat source. The heat emission of this source is known to be a function of time. It is assumed that both electrodes consist of one and the same homogeneous metal, and the heat dispersion in the layer of the dielectricum between the electrodes is neglected. At first the distribution of the temperature in the electrodes is determined. For this purpose the distribution of temperature for the case that a heat source exists is sought. One then passes on to a surface heat source, assuming that the surface of the heat source is round. The formula for temperature is set up for this case, and by putting T equal to the melting temperature and t equal to the duration of impulse, it is possible to determine the depth h of erosion as a function of T and t . From the diagrams it may be seen that the size of the surface of the heat source exercises considerable influence on the depth of the erosion. Inexact knowledge of this quantity may lead to grave errors. In view of the fact that for the purpose of checking theoretical conclusions it is necessary to know the surface of the heat source, and only the diameter of the erosion can be determined with certainty, it was necessary to

^vŽurn.techn.fis,26, fasc.9, 2008-2020 (1956) CARD 2 / 2

PA - 1497

find a method for the exact measuring of the same. In order to find the diameter of the erosion the attempt was made to find out to what extent it is larger than the diameter of the discharge channel. The latter can be determined by means of the formula of Drabkina (Žurn.techn.fis, 21, 473 (1951)). The experimental verification of this formula showed good agreement with experimental results. According to the formula, the velocity of the expansion of the discharge channel exceeds the velocity with which the diameter of the erosion increases by a multiple. Herefrom it is concluded that the diameter of the erosion is determined by the diameter of the discharge channel and that it cannot be very much larger than the latter. This was verified by experiments which show that the diameter of the erosion is not determined by the passage of heat but solely by the cross section of the discharge channel. Test installations have already been described in a previous work (Žurn.techn.fis,26,fasc.5 (1956)). - Summatizing it may be said that the melting of the metal is brought about by that heat which comes from the discharge channel of the electrode and therefore is propagated in the metal. The depth of the erosion is determined only by the thermal characteristics of the metal, the size of the surface of contact between the discharge channel and the electrode, and by the energy emitted in the discharge channel. The diameter of the erosion is determined by the cross section of the discharge channel.

INSTITUTION: Institute for Cinematographic Engineers, Leningrad.

ZINGERMAN, A.S.

SUBJECT USSR / PHYSICS
 AUTHOR ZINGERMAN, A.S.
 TITLE The Dependence of Pressure on the Front of a Shock Wave on the Steepness of the Front of the Energy Shock on the Occasion of the Electric Discharge in a Liquid.
 PERIODICAL Zurn.techn.fis, 26, Fasc.11, 2539-2540 (1956)
 Issued: 12 / 1956

CARD 1 / 2

PA - 1688

At first some previous works dealing with this problem are mentioned. Very often the energy shock occurring on the occasion of a discharge is of nearly triangular shape with a steep front and a flatter rear side. Nothing essential is changed by replacing the exponential shape of the impulse by an oblique shape which differs from it but slightly while the total energy of the energy shock under investigation is conserved, but computation is simplified and permits the drawing of conclusions of a general character. If for the oblique shape of the energy shock the formula developed by DRABKIN, Zurn. eksp.i teor.fis, 21, 473 (1951) is used, we find $p = (\rho/T)(qW)^{1/2} B$ for the pressure on the front of the shock wave. Here ρ denotes the density of the liquid, W - the total energy of the energy shock per unit of the length of the channel, T - duration of the energy shock, τ - the duration of the front, $\theta = \tau : T$. For the factor B a long expression is explicitly given. A diagram shows the curve $B(\tau)$ for four different energy shocks with the same total energy but with different duration of the front. Like in the case of

Zurn.techn.fis, 26, fasc.11, 2539-2540 (1956) CARD 2 / 2

PA - 1688

the curves of B, also pressure on the front of the shock wave changes. The maximum pressure is $p_{\max} = \beta \sqrt{Q W / S T}$. Maximum pressure grows with increasing density of the liquid, increasing total energy of the energy shock, and with diminishing total duration of the front. The time, after the elapse of which pressure becomes equal to zero, is $t_{p=0} = T(1 + \sqrt{1-Q})$. β denotes a composed integral function $\beta = c_p/c_v$, which was found by DRABKIN. In liquids β differs only little from 1, but in the case of $\beta = 1$ the expression for β becomes indefinite. As indetermination is not successfully discovered, the value of β at $\beta = 1$ was determined by extrapolation from the curve $\beta(\gamma)$; it amounts to 0,7.

INSTITUTION:

ZINGERMAN, A. S.

AUTHOR: Zingerman, A. S.

126-1-9/40

TITLE: Electroerosion properties of metals. (Elektroerozionnyye svoystva metallov).

PERIODICAL: Fizika Metallov i Metallovedeniye, 1957, Vol.5, No.1, pp. 58-67 (USSR)

ABSTRACT: Electric erosion of metals is effected by the heat transmitted from the discharge canal to the electrodes. With increasing energy and pulse duration, the rate of erosion increases. However, in the case of excessive pulse durations, the erosion stops owing to a reduction of the energy density caused by an increase in the cross section of the discharge canal. The dependence of the critical pulse energy on the critical pulse duration represents the limit of electric erosion. The maximum erosion and its position, the critical energy, the critical duration, the boundary location and the zone of predominant erosion depend on the properties of the metals of both electrodes, the medium and to some extent on the shape of the energy pulse. The thermophysical properties of the metals determine only the relative stability of the metal against electric erosion, the polarity coefficient and thereby the beginning of phase transformations. During electroerosion, pittings form on the

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Electroerosion properties of metals.

126-1-9/40

electrodes with the shape of a solid of revolution. The erosion intensity is measured by the volume of the pittings. In earlier work (Ref.1) the author showed that the diameter of the pitting d is equal to the diameter of the discharge canal and derived a formula for it, Eq.(1), p.58, by transforming a formula proposed by S. I. Drabkina (Ref.2) expressing the relation between the diameter of a discharge canal and the energy liberated by the discharge. This formula was verified by a number of experimental results (Ref.9) and it was found to express correctly the relation between the diameter of the pitting and the pulse energy and duration. A formula was also derived for calculating the depth h of the pitting, Eq.(2), p.59, which shows that the depth of the pitting depends not only on the energy and duration of the pulse but also on the diameter of the pitting; increase in the diameter will result in a reduction of the depth. The formula for calculating the depth is based on the assumption of a uniform distribution of the energy along the cross section of the discharge canal and does not take into consideration the widening of the discharge canal during the process

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Electroerosion properties of metals.

126-1-9/40

of the discharge. However, experiments show that the error involved is not very large. The sketch, Fig.2, shows calculated shapes of pittings, taking into consideration the widening of the discharge canal, for steel and copper and it can be seen that the calculated shapes are in good agreement with experimentally determined shapes. The volume of the pitting depends on the full heat energy of the pulse and its duration. The author calculates the critical energy density W_k and the limits of electroerosion. According to theoretical considerations, the limit values of electroerosion are not determined by a line but by a band representing the sum of lines, each of which corresponds to a certain erosion probability, whereby the top limit line corresponds to a probability of 100%, i.e. a pulse of the given energy and duration will always produce erosion; the bottom limit line corresponds to zero probability. In Fig.7 experimental curves are graphed for steel and copper with a brass counter electrode. The experiments showed that for pulse durations of 400 μ secs the erosion of steel with a brass counter-electrode inside glycerine decreases with decreasing

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Electroerosion properties of metals.

126-1-9/40

full pulse energy. For a pulse energy of 0.25 Joule, erosion stops. The stability of metals against erosion depends on a number of factors which are discussed in the paper including counter-electrode, operating medium, pulse duration, etc. In the case of small pulse energies, it is the anode which is predominantly eroded, whilst in the case of large pulse energies, it is primarily the cathode which is eroded. It was established theoretically and by experiments that zones of preferential erosion exist. A formula is derived which expresses the ratio of the time required for setting in of melting or evaporation of the cathode and the anode and this formula enables determination of the electrode which will first be affected by phase transformations. In the final paragraph of the paper the conditions are discussed for which the derived formulae are applicable. The obtained results seem to justify the assumption that there are no limits to the validity of the arrived at practical conclusions.

Card 4/5

There are 7 figures, 1 table and 9 references, all of which are Slavic.

SUBMITTED: Dec.6, 1955 (initially), May 25,1956 (after revision)

Electroerosion properties of metals.

126-1-9/40

ASSOCIATION: Leningrad Institute of Cinema Officials.
(Leningradskiy Institut Kinoinzhenery).

AVAILABLE: Library of Congress.

Card 5/5

ZINGERMAN, A.S.

AUTHORS: Zingerman, A.S. and Kaplan, D.A.

121-4-5/32

TITLE: Investigation of the Power Supply for Electric Spark
Machines (Issledovaniye ustochnika pitaniya elektroiskrovnykh
stankov)

PERIODICAL: Stanki i Instrument, 1958, No.4, pp. 14 - 15 (USSR).

ABSTRACT: Oscillographic records were taken in examining the operation of the impulse generator of the resistance-capacitance type feeding an JK3-18 electric spark machine. 12 mm diameter brass electrodes were used with paraffin as the liquid medium. The discharge current and voltage between electrodes were recorded at different values of the capacitance between 1.5 and 210 microfarads. The values of the current peak, the duration of the impulse and the energy discharged during the first half-wave are stated in the table and plotted in the graph. The study revealed a large scatter of the voltage and the energy discharge caused by a premature breakdown of the electrode gap. The actual working process (duration of impulse) takes only 10% of the total time (100 μ sec. in a 1 millisecc. cycle). The reasons for the scatter are a low de-ionisation rate, the presence of erosion products in the gap and the formation of inter-electrode bridges. A simple partial remedy is filtration of the liquid. There are 2 figures, 1 table and 3 Russian references.

AVAILABLE: Library of Congress
Card1/1 1. Impulse generators-Power supply

ZINGERMAN, A. S.

57-2-26/32

AUTHORS: Zingerman, A. S. , Kaplan, D. A.

TITLE: The Dependence of the Electric Erosion of the Anode on the Distance Between the Electrodes (Zavisimost' elektricheskoy erozii anoda ot rastoyaniya mezhdu elektrodami)

PERIODICAL: Zhurnal Tekhnicheskoy Fiziki, 1958, Vol. 28, Nr 2, pp.387-393 (USSR)

ABSTRACT: The tests performed here were conducted in the apparatus described in reference 2. Based on them the following was determined: 1) An increase in the distance between the electrodes causes: a) an increase in the energy developed in the discharge between the aluminum-, copper- and steel-electrodes; the increase in energy becomes observable in distances of more than 75 - 100 μ ; b) an increase in the cavity-diameter in aluminum, copper and steel. 2.) An increase in the distance between the electrodes up to 75 - 100 μ does not cause a change in the cavity depth in aluminum, copper, steel and brass. Upon further increase in this distance the cavity depth very

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57-2-26/32

The Dependence of the Electric Erosion of the Anode on the Distance Between the Electrodes

highly decreases in all above-mentioned metals. 3.) The cavity volume in aluminum, copper and steel increase with an increase in the interelectrode-distance to a certain maximum value which is attained at a distance of 100 - 250 μ . At a greater distance the cavity volume begins to decrease. 4.) The cavity volume in soft metals is smaller than that in fused metals. With an increase in the interelectrode-distance the volume of the condensed metal which is transferred from the opposite electrode also increases. 5.) The energy liberated in the discharge-channel between the brass-electrodes does not change at an interelectrode-distance of below 100 μ , where the cavity depth does not change either. 6.) A decrease in the cavity depth and its volume at an interelectrode-distance of more than 100 μ may be explained by the loss of energy in the discharge-channel. 7.) The loss of energy in the discharge-channel at a length of the channel of below 100 μ is not high and amounts to 1 - 11 %. At a greater distance the losses of energy rapidly increase and at a distance between steel-electrodes of 500 μ the energy transferred by the electrodes can be evaluated with 25 - 35 % of the full pulse-energy. 8.) At an interelectrode-distance of below 100 μ the structure of the dis-

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The Dependence of the Electric Erosion of the Anode on the Distance Between the Electrodes

charge-channel is apparently little dependent on the length of the channel. At a greater distance the structure of the channel, like the phenomena taking place in it, changes to a considerable extent. There are 9 figures, 1 table, 7 references, 5 of which are Slavic.

SUBMITTED: May 16, 1957

AVAILABLE: Library of Congress

1. Anodes-Erosion
2. Anodes-Cavitation
3. Anodes-Test methods
4. Anodes-Test results

Card 3/3

AUTHORS: Zingerman, A. S., Kaplan, D. A. 57-28-6-22/34

TITLE: On Fluctuations in a Discharge Channel (O fluktuatsiyakh v razryadnom kanale)

PERIODICAL: Zhurnal Tekhnicheskoy Fiziki, 1958, Vol. 28, Nr 6, pp. 1267 - 1274 (USSR)

ABSTRACT: The presence of jags on the voltage oscillogram and a lack of jags on the current oscillograms indicates a sudden change of resistance in the discharge channel. As the jags are irregular and of different height, the change of voltage has the character of a fluctuation. Elementary phenomena causing breakdowns over long gaps become insignificant in breakdown processes taking place over very short gaps. The basic condition of breakdown is the non-stable development of the process, which requires an ever-increasing reduction of the initial electrons (Reference 4 and 5). Ordinary secondary processes cannot warrant an effective reduction of initial electrons. Therefore the character of primary as well as of secondary processes must differ in the case of very short gaps. What has been said about breakdown - the initial stage of electric discharge - is true

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On Fluctuations in a Discharge Channel

57-28-6-22/34

also for the arc itself. The suggested mechanism of a very short arc has been experimentally confirmed. The process of cold emission is of a statistical nature. The statistical character is even more stressed by the influence exercised by positive ions. Thus, the arc mechanism suggested by Germer and Haworth is statistic. This form of statistics manifests itself in the shape of a considerable fluctuation of voltage. According to the arc mechanism the fluctuation is caused by the processes on the cathode, which fact was confirmed experimentally. As the work function depends more or less on the cathode material and on the nonconductive film on its surface, fluctuation must also depend on the material of the cathode. In the case of strong currents the section of the channel changes. If emission from a part of the cathode decreases, it increases in another part, and the average state of the discharge channel is subjected to slight deviations. This causes the voltage curve to be balanced. There are 10 figures and 19 references, 6 of which are Soviet.

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On Fluctuations in a Discharge Channel

57-28-6-22/34

ASSOCIATION: Leningradskiy institut kinoinzhenerov (Leningrad Institute
of Cinematographical Engineers)

SUBMITTED: July 1, 1957

1. Electric discharges—Theory 2. Electric discharges—
Statistical analysis 3. Cathodes—Properties 4. Work
functions

Card 3/3

ZINGERMAN, A.S.; KAPLAN, D.A.

Investigating supply sources of electric spark machines. Stan. 1
instr. 29 no.4:14-15 Ap '58. (MIRA 11:5)
(Metal cutting, Electric)
(Oscillators, Electric)

ZINGHERMAN, A.S.

Volume of fused metal during electric erosion. Viz. tver. tela
l no.2:284-289 F '59. (MIRA 12:5)
(Corrosion and anticorrosives) (Electric discharges)

SOV/144-59-7-12/17

AUTHORS: Zingerman, A.S., (Cand. Tech. Sci., Docent, in Charge of the Chair of Electro-Technology) and Litshits, A.L., (Cand. Tech. Sci., Director of the Laboratory for Electrical Methods of Machining)

TITLE: On the Physical Nature of Electro-erosion Machining of Metals

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Elektromekhanika, 1959, Nr 7, pp 78-93 (USSR)

ABSTRACT: Electric erosion is a complicated phenomenon which depends on a number of factors, of which the shape of the energy pulse fed to the discharge gap is the most important. By changing the shape of this pulse it is possible to change considerably the quantitative and the qualitative phenomena of electric erosion. It is due to this factor that a great variety of electro-erosion processes of machining are used and it is also due to this factor that during the last seven to eight years the productivity of electro-erosion machining has increased very appreciably and the rate of wear of the tools has dropped to a small fraction of what it was before (Ref 2). Electric pulse (pulse-arc) machining of metals, proposed in 1950 by one of the authors of this paper (Ref 1) and based on arc

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SOV/144-59-7-12/17

On the Physical Nature of Electro-erosion Machining of Metals
discharges produced by unipolar pulses of energy of relatively long duration, enabled increasing the productivity by a factor of about 10 as compared to that obtained with electric spark methods. Further development of electro-erosion machining and of new, more perfect variants of this type of machining, is closely linked with the study of the physical nature of electric erosion and of the processes accompanying this phenomenon. In this paper the authors review the present state of the development of theories and view of Soviet as well as of foreign authors on the physical phenomena of electro-erosion. In the first part the theoretical views, expressed by numerous authors, are discussed. In the second part available experimental data are reviewed under the following headings: applied test techniques; relation between the energy transmitted to the electrodes and that released in the discharge canal; influence of the pulse energy on the diameter and the depth of the produced cavity; influence of the pulse energy on electro-erosion; influence of the electrode spacing on the magnitude of the erosion; influence of the dielectric medium on the electro-erosion; influence of the electrode

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SOV/144-59-7-12/17

On the Physical Nature of Electro-erosion Machining of Metals

material on the electro-erosion; influence of the electrode polarity on the electro-erosion; shape of the cavity profiles; pressures on the electrodes; dynamics of the process of formation of cavities. In conclusion the authors state that the available experimental data are inadequate for evolving a theory of the pertaining phenomena. Further systematic physical experiments are necessary for verifying and accumulating data and establishing empirical relations of this phenomena. In evolving a technological theory of electro-erosion machining of metals it is necessary to start off from the more simple phenomenon using a single pulse. However, change-over to technological conditions cannot be effected by purely arithmetical adding up of individual phenomena. It is necessary to elucidate the relations between the individual factors and their statistical distribution, for instance, the breakdown strength of a medium or other physical and chemical factors may not be of any importance in purely physical experiments but may have a considerable influence on the technological characteristics.

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On the Physical Nature of Electro-erosion Machining of Metals

Development of the physical theory of electro-erosion is only the first step in developing physical fundamentals of the technology of electro-erosion machining of metals.

Card 4/4 There are 53 references, of which 31 are Soviet, 13 English, 3 German, 2 Polish and 4 Czech.

ASSOCIATION: Kafedra elektrotekhniki, Leningradskiy institut kino-inzhenerov (Chair of Electro-Technology, Leningrad Institute of Cine-Engineers) (Zingerman); and Laboratoriya elektricheskikh metodov obrabotki, ENIMS (Laboratory for Electrical Methods of Machining, ENIMS) (Livshits)

SUBMITTED: November 24, 1958

80567

S/144/60/000/05/009/014
E194/E255

18.8100

AUTHOR: Zingerman, A. S. Candidate of Technical Sciences

TITLE: The Thermal Theory of Electrical Erosion of Metals 18

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy,
Elektromekhanika, 1960, Nr 5, pp 87-98 (USSR)

ABSTRACT: The opinion was expressed about fifty years ago that thermal processes at the electrodes are amongst the main factors in the electrical erosion of metals. Later studies with the electron microscope and by X-ray structural analysis revealed structural changes in the metal that could be explained by the action of a heat wave with very steep front and strong damping. In developing the thermal theory of the electrical erosion of metals it is necessary to consider possible sources of heat and their effects. One such source of heat is the electric current passing through the electrodes. On this basis, calculations may be made of the volume of metal raised to melting point and it has been found that only in metals with high electrical resistance can melting occur by simple resistive heating and then only in the early stages of discharge and to a small extent.

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The Thermal Theory of Electrical Erosion of Metals

Thus heat generated in the electrode by its internal resistance plays a very small part in the process. The discharge channel itself could be a second source of heat. Heat from the channel passes to the electrode in contact with it; the metal is gradually heated and melted. The metal might be removed either instantaneously at the end of the discharge or continuously as it is melted. In the first of these hypotheses, the source of heat is a surface that is relatively small compared with an electrode. To determine the volume of the molten metal it is necessary to calculate the temperature field in the electrode, for which purpose it is only necessary to know the energy density transmitted to the electrode as a function of time. This function may be determined by taking oscillographs of discharge voltage and current. Tests have shown that the amount of energy transmitted to the electrodes depends on the distance between them, and when the separation is 5, 25, 50, 100 and 500 microns the respective percentages of the evolved energy transmitted to the electrodes are 99, 95, 93, 89 and 25 to 35%. The distribution of energy between anode and cathode

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The Thermal Theory of Electrical Erosion of Metals

depends on the time, but as it is not clearly known it is assumed to be equal between them. The calculations are equivalent to calculating the temperature field in a semi-infinite medium having on its surface a circular heat-source of given radius and time function. An equation has been derived that fits the boundary conditions and the temperature distribution may be calculated from expression (1). The method of calculating the depth to which the metal is melted is explained and expression (2) is derived. Expression (2) relates to a source of unlimited dimensions; a correction factor, given by equation (3), must be used to correct for the size of a limited source. Numerical values of correction factor are given in Table 1. Expression (2) may be modified to give the electrode surface temperature in the form of expression (6). The various formulae derived do not take account of the relationship between the thermal-physical coefficients of the material and the temperature. Nor do they allow for the influence of the aggregate condition of the material on its thermal-physical.

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The Thermal Theory of Electrical Erosion of Metals

properties or for the heat required to melt the metal. An accurate solution allowing for these factors and for changes in the surface temperature of the electrodes during the process of discharge is very difficult. Therefore, possible errors of an approximate solution are evaluated and methods of reducing them considered. The energy loss due to the latent heat of fusion may be allowed for by introducing an equivalent negative source of heat located on the boundary between the molten and solid metal and moving together with it. The negative temperature field of this heat source is superimposed on the temperature field due to the main source. In the case when the plane surface of the semi-infinite body is at constant temperature the problem is then uni-dimensional and the total temperature field is given by expression (9a) for the liquid phase and (9b) for the solid phase. In these equations β is a factor that governs the position of the boundary between the solid and liquid phases; it may be determined from Eq (10). Another method of locating the boundary between phases is given, and it is shown that formula (8) can be used to locate this boundary with

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The Thermal Theory of Electrical Erosion of Metals

allowance for the specific heat of fusion, if the melting point is replaced by an equivalent melting point given by expression (14). Values of β for steel, aluminium and zinc as function of temperature are plotted in Fig 1. In this way the latent heat of fusion may be allowed for, but no allowance is made for changes in the thermal-physical properties of the metal. The method of conjugate solutions may be used; it requires two solutions of the differential Eq (15) for the liquid and solid phase which satisfy the appropriate conditions on the boundary of separation, with allowance for the specific heat of fusion. The solution of a similar problem of the displacement of the boundary between phases during solidification of a semi-infinite body at constant temperature was given by Stefan. His formulae, suitably modified, give expression (16a) for the temperature distribution of the liquid phase and (16b) for the solid phase. Eq (17) is then simply derived, which, together with formula (7), can be used to determine the position of the phase boundary. Curves of the temperature

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The Thermal Theory of Electrical Erosion of Metals

distribution of steel and aluminium using formulae (16) and (8) are plotted in Fig 2. The graph shows that if the relationship between the thermal-physical coefficients and the aggregate conditions is neglected the resulting error is appreciable. Fig 3 gives curves of temperature distribution in steel at a temperature of 3000°C , and in aluminium at a temperature of 2500°C , calculated by formulae (7) and (8). It will be seen that the use of formula (8) to determine the depth of molten metal involves no great error if the thermal conductivity used is that for liquid metal. The error is appreciably greater if the whole metal is assumed to have a thermal conductivity corresponding to the solid state. Formulae are derived which show that this error depends on the thermal-physical properties of the metal and its surface temperature, the error is quite small at temperatures up to $10\,000^{\circ}\text{C}$, not exceeding 2 to 6% for steel, and 1 to 3% for aluminium. Thus the depth of melting can be determined reasonably accurately when the source is of limited dimensions. In all the calculations the mean values of thermal-physical properties of metal given in Table 2 were used. The theory of melting

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The Thermal Theory of Electrical Erosion of Metals

with continuous removal of metal is then considered. If the electrode surface is steadily heated up to the melting point, the temperature distribution is given by formula (1). If the molten metal is then removed the electrode temperature changes. If the origin of the coordinates is located on the electrode surface it is displaced as the molten metal is removed. Assume that the electrode is infinite, the thickness of the layer of molten metal small and the electrode surface temperature constant; it then follows that the temperature distribution of the electrodes is displaced without change together with the origin of coordinates. Thus the energy transmitted to the electrode through each unit of its surface is expended in melting metal and heating the electrode. The energy balance is then given by expression (21). The solution of this equation is obtained in the form of expression (22), which gives the depth of metal melted. Depths of melting under particular conditions for steel and aluminium calculated by formulae (22) and (2) are given in Table 3. Current calculations are also given. The table shows that the calculated depth of melting is somewhat greater if it

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The Thermal Theory of Electrical Erosion of Metals

is assumed that the molten metal is continuously removed. There is a third mechanism by which metals may be removed. If the electrode receives a short high-energy impulse, all the metal in a certain volume is vapourised and removed as a jet of vapour. The theory of this mechanism is based on the idea of a volume in which the ratio of received to transmitted energy is very great. The energy leaves the volume mainly by radiation and conduction, and radiation from molten metal is less than that of an absolute black body by a factor of 3 or 4. It is shown that the amount of energy radiated is an inconsiderable part of that received and the loss of energy by conduction may be calculated by expression (25). Various expressions are derived, on the assumption that the energy removed by conductivity is rather less than the energy received: expressions (29) and (30) give the conditions of explosive vapourisation. They show that for a given duration of impulse, explosive vapourisation occurs if the energy density of the impulse satisfies expression (30); then the depth of molten metal may be calculated from expression (29). The theory of explosive vapourisation

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The Thermal Theory of Electrical Erosion of Metals

is somewhat idealised. It assumes that the whole of the volume is uniformly heated to the vapourisation temperature, whereas in fact the temperature distribution is not uniform and part of the metal is heated to a higher temperature, whilst some remains colder. The vapour leaves the molten metal at a certain initial speed and may carry part of the liquid metal with it. It is not possible to calculate these effects, but the high speeds sometimes observed with explosive vapourisation probably result from a combination of the various effects. There are 4 figures, 3 tables and 11 references, 8 of which are Soviet, 1 Russian apparently translated from English and 2 German.

ASSOCIATION: Leningradskiy institut kinoinzhenerov
(Leningrad Institute of Cinematograph Engineers)

SUBMITTED: October 21, 1959

Card 9/9

ZINGERMAN, A.S.

Formation of crystalline graphite in an electric arc burning in mineral oil. Izv. vys. ucheb. zav.; fiz. no.5:173-174. '63. (MIRA 16:12)

1. Leningradskiy institut kinoinzhenerov.

ZINGERMAN, A.S.

The mechanism underlying electric corrosion. Izv. vys.
ucheb. zav; fiz. no.1:20-40 '63. (MIRA 16:5)

1. Leningradskiy institut kineinzhenerov.
(Electric discharges)

ZINGERMAN, A.S., inzh.; KAPLAN, D.A., inzh.

Concerning the article "Balance of energy in a spark gap with a
low-voltage impulse discharge in a liquid dielectric medium."
Vest.elektroprom. 33 no.12:61-64 D '62.
(Electric discharges)

(MIRA 15:12)

"APPROVED FOR RELEASE: 07/16/2001

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APPROVED FOR RELEASE: 07/16/2001

CIA-RDP86-00513R002065220006-8"

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1202/R12

... In the experiments energy pulses of identical ... the discharge taking place ... a rod electrode of 2 to 4 mm diameter with a ... hemispherical tip and an interelectrode spacing of 25 μ. The ... was filled with mineral oil.

Card 3/3

ZINGERMAN, Aleksandr Solomonovich, kand.tekhn.nauk, dotsent

Study of metal ejection in an electric erosion process. Izv.vys.ucheb.
zav.; elektromekh. 5 no.1:99-100 '62. (MIRA 15:2)

1. Zaveduyushchiy kafedroy elektrotekhniki, Leningradskiy institut
kinoizhenerov.

(Electrometallurgy)

33962

S/144/62/000/001/002/002
D224/D301

26.2311
AUTHOR: Zingerman, A.S., Candidate of Technical Sciences, Docent
TITLE: Investigating the process of ejection of metal in electrical erosion
PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Elektromekhanika, no. 1, 1962, 99-100

TEXT: Electrical erosion of metal was investigated experimentally by applying unipolar pulse discharges of duration of 5 to 20 m/sec. between a graphite rod electrode and a plate made of steel, copper, aluminum or graphite. The discharge was produced in air or in oil. High-speed photographs of the discharge were taken. These showed that removal of the metal from the cathode begins with explosive evaporation; the latter took place with interruptions during the whole period of the discharge. The explosive evaporation was found to depend inversely on the energy of the pulse. No explosive evaporation was observed on the anode. Ejection of particles from the electrodes begins later; no substantial difference

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D224/D301

Investigating the process ...

in ejection from the cathode and the anode was noticed. From steel the particles were ejected in a continuous flow in all directions. From copper and aluminum the particles were ejected in intermittent beams in random directions, the number of particles being smaller than in previous case, but their size larger. This may be explained by different degrees of nonuniformity of structure of metals, and by the presence of areas with different thermo-physical properties affecting the monotonic distribution of the temperature field. It is stated that the formation of cavities is due to consecutive random ejections of metal particles. If the energy of the pulse is small the cavities do not overlap and are scattered over some area. Hypotheses of other authors are discussed and stated to be unsatisfactory. There are 13 references: 11 Soviet-bloc and 2 non-Soviet bloc. The references to the English-language publications read as follows: J.M. Somerville and W.R. Bievin, Phys.Rev., 76, 982, 1946; J.M. Somerville and C.T. Grainger, Brit. J.Appl. Phys., 7, 109, 400, 1956.

ASSOCIATION: Leningradskiy institut kincinzhenerov, Kafedra elektrotekhniki (Leningrad, Institute of Cine Engineers, Department of Electrical Engineering)

Card 2/3

ZINGERMAN, A.S.; LIVSHITS, A.L.; ARONOV, A.I.

Wear of electrode tools made of a graphitized material caused by
electric pulse cutting of metals. Stan.i instr. 32 no.6:20-22
Je '61.

(MJRA 14:6)

(Electric metal cutting)

ZINGERMAN, A.S.; KAPLAN, D.A.

Discharge voltage of a short pulse arc. Izv. vys. ucheb. zav.; fiz.
no.6:165-166 '60. (MIRA 14:3)

1. Leningradskiy institut kinoinzhenerov.
(Electric arc)

23431

S/121/61/000/006/006/012
DO40/D112

1.1110

AUTHORS: Zingerman, A.S., Livshits, A.L., and Aronov, A.I.

TITLE: Wear of graphitized tool-electrodes in electrospark machining of metals

PERIODICAL: Stanki 1 instrument, no.6, 1961, 20-22

TEXT: Electrodes of special graphitized material 39Г (EEG) were tested in experiments on a "473" electrospark machine. [Abstracter's note: No information on the composition and of the EEG and the production technology of the electrodes is included]. The material is now being mass-produced. Maximum relative wear (or consumption of the electrode in relation to the volume of removed metal) of EEG electrodes is about 2.5% in the center and 0.1-0.5% at the periphery, compared with 80-100% of old tool-electrodes. Oil (industrial "12" grade) pumped at a pressure of 0.5 gauge atmospheres into the spark gap reduced wear to a minimum; wear decreased with longer electric pulses (Table 2):

Work current, amps		Pulse duration in microseconds				
		900	415	170	120	75
	Wear (%)	0.3	0.3	0.3	0.3	1.7
Card 1/3	20	0.5	0.5	2.0	5.0	6.0

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Wear of graphitized tool-electrodes

S/121/61/000/006/006/012
D040/D112

The erosion resistance corresponded to Palatnik's criterion (Ref.4: Palatnik, L.S., "Doklady AN SSSR", t. 89, 1953, str.455; Ref.5: Zingerman, A.S., Fizika metallov i metallovedeniye, t. V, 1957, str.58);

$$\Pi = c \gamma \lambda T_n^2,$$

where c is heat capacity, γ - density; λ - heat conduction; T_n - reduced melting temperature (taking into account the latent fusion heat). EEG had 5-30 times higher erosion resistance than metals. Five times more metal was removed in the work process by using inverse polarity (workpiece for cathode, tool-electrode for anode) than with direct, and cathode wear was practically absent when single pulses were used. Transfer of metal from the workpiece was by splatter with droplets much less than 1 micron in size. Aluminum was not transferred to the graphitized cathode, and copper and steel only slightly, but the transfer of copper and steel to the anode was intense. No carbon was transferred from the electrode to the workpiece. This is due to the vaporous state of graphite during the electric discharges. The combinations of anode-graphitized material, and steel-cathode are good, for metal strengthens the electrode but does not absorb carbon. A fresh carbon layer liberated from oil continually restored the electrode surface. It was examined (by L.S. Palatnik) by X-ray analysis and found to be crystalline graphite.

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Wear of graphitized tool-electrodes

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D040/D112

No graphite layer formed when the oil was replaced by inorganic fluid. This carbon stuck very firmly to the EEG and its mechanical strength was much higher than that of the EEG. The approximate formula for the rate of carbon formation is:

$$\delta = 0.33 \cdot 10^{-10} (T - 1100)^3 \text{ micron/millisecond,}$$
 where T is the electrode temperature (in °C) in the work zone. The carbon forms from oil particularly intensely in an arc, and 4 times faster on the cathode than on the anode (0.33 micron/millisecond on the anode). The layer fills the gap rapidly and causes a short circuit. The mechanical strength and porosity affected wear - 8 times lower mechanical strength was accompanied by 21 times more rapid wear. Conclusions: Two opposite processes are acting in electrospark machining with EEG - disintegration and restoration. The restored layer is several microns deep and has much higher mechanical strength and erosion resistance than the base material. The rate of disintegration and restoration depends on the power, duration and duty factor reciprocal of the pulses, the worked surface area and depth of removed metal, pressure on pumped fluid, and other factors. Electrode wear can vary between 0.1 and 2.5%. When the combination of operation factors is correct, wear of EEG electrode tools on steel is between 0.3 and 0.8%. In some cases it is even possible that the rate of restoration is higher than that of disintegration. There are 4 tables and 6 Soviet-bloc references.

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ZINGERMAN, A.S.

Shape of the craters produced by electric erosion of metals.
Trudy LIKI no. 5:82-90 '59. (MIRA 13:12)

1. Kafedra elektrotekhniki Leningradskogo instituta kincinshtenirov.
(Electric metal cutting)

26.2311

88058

24,2120 (1049, 1160, 1482)

S/139/60/000/006/027/032
E032/E414

AUTHORS: Zingerman, A.S. and Kaplan, D.A.

TITLE: Discharge Voltage of a Short Pulsed Arc

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika,
1960, No. 6, pp. 165-166

TEXT: The aim of the present work was to investigate the effect of electrode material and the medium between the electrodes on the magnitude of the discharge voltage. The apparatus used in these experiments and the method employed were described by A.S. Zingerman in Ref. 1. All the experiments were carried out with 320 μ F capacitors and a voltage of 1000 V. One of the electrodes was in the form of a plate (45 x 35 x 1.5 mm) and the other in the form of a rod having a diameter of 3 to 4 mm. One end of the rod was hemispherical. The electrodes were polished to "Class 13 purity". A constant gap of 8 μ was maintained between the electrodes. Two groups of experiments were carried out. In the first group, the effect of the medium was investigated. In these experiments brass or steel electrodes

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S/139/60/000/OG6/027/032
EO32/E414**Discharge Voltage of a Short Pulsed Arc**

were employed and the plane electrode was always at a positive potential. In the second group of experiments, a study was made of the effect of the material of the electrodes. In these experiments ordinary solar oil was used as the medium between the electrodes. Four series of experiments were carried out in this group. In the first two of these the plane electrode was made of brass and was kept positive in the first series and negative in the second. In the third and fourth series of experiments, the plane electrode was made of steel and was also either at a positive or a negative potential. In these experiments the rod electrode was of various materials, namely steel, aluminium, copper, brass or molybdenum. Only the voltage oscillograms were taken since it was established earlier that neither the material of the electrodes nor the medium between them have any effect on the form of the current curve or its amplitude. The current oscillogram had the following form: the current rose to a maximum of 1920 amps in 300 μ sec and its value was 7% of the amplitude value in 300 μ sec. The voltage oscillograms obtained

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S/139/60/000/006/027/032
EO32/E414

Discharge Voltage of a Short Pulsed Arc

with brass electrodes and water, castor oil, glycerine, transformer oil, liquid glass, water solution of borax and boric acid, kerosene and air as the media did not differ from each other either in form or in magnitude. The same result was obtained with steel electrodes and the above media. Thus the magnitude of the discharge voltage and the energy dissipated in the discharge channel are independent of the nature of the medium in which the discharge takes place. With given anode material, it was found that the form and the magnitude of the discharge voltage are strongly dependent on the cathode material. Thus, for example, with a steel cathode the voltage is 1.5 to 1.8 times greater than that with a brass cathode. With given cathode material, the oscillograms are not very different from each other whatever the anode material. The general conclusion is, therefore, that the discharge voltage of a short pulsed arc is very dependent on the cathode material and to a much lesser extent on the anode material. The medium between the electrodes has no effect on the form and magnitude of the

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E032/E414

Discharge Voltage of a Short Pulsed Arc

discharge voltage and this suggests that the discharge takes place in the vapours of the electrode materials, and mostly in the vapour of the cathode material. There are 2 figures and 1 Soviet reference.

ASSOCIATION: Leningradskiy institut kinoinzhenerov
(Leningrad Institute of Motion Picture Engineering)

SUBMITTED: October 21, 1959

Card 4/4

ZINGERMAN, A.S.

Application of high-speed motion-picture photography in
studying electric erosion. Usp.nauch.fot. 9:262-264

'64.

(MIRA 18:11)

ZINGERMAN, Aleksandr Solomonovich, kand.tekhn.nauk, dotsent

Thermal theories on the electric erosion of metals. Izv.
vys.ucheb.zav.; elektromekh. 3 no.5:87-98 '60.
(MIRA 13:7)

1. Zaveduyushchiy kafedroy elektrotekhniki Leningradskogo
instituta kinoinzhenerov.
(Electrodes)

PAP, A.M.; VISHNEVSKIY, V.M.; ZINGERMAN, A.Ya.

Morphology and some tectonic characteristics of the Mikashevichi-Zhitkovichi horst in the crystalline basement of White Russia.

Dokl.AN BSSR 6 no.4:243-246 Ap '62.

(MIRA 15:4)

1. Institut geologicheskikh nauk AN BSSR i Luninskaya geologoposkovaya partiya Belglavgeologii. Predstavleno akademikom AN BSSR G.V.Bogomolovym.

(Mikashevichi region—Geology, Structural)

(Zhitkovichi region—Geology, Structural)

ZINGERMAN, L. S.

Restoration of the patency of the coronary arteries by means of
endarterectomy (review of foreign literature). Grud. khir. no.5:
123-127 '61. (MIRA 15:2)

1. Iz Instituta grudnoy khirurgii (dir. - prof. S. A. Kolesnikov;
nauchnyy rukovoditel' - akad. A. N. Bakulev) AMN SSSR.

(CORONARY VESSELS---SURGERY)

BAKULEV, A. N.; ZINGERMAN, L. S.

Technic of coronary endarterectomy (Experimental study). Grud.
khir. no.2:25-28 '62. (MIRA 15:4)

1. Iz Instituta serdечно-сосудистой khirurgii (dir. - prof.
S. A. Kolesnikov; nauchnyy rukovoditel' - akad. A. N. Bakulev)
AMN SSSR.

(CORONARY VESSELS--SURGERY)

ZINGERMAN, L.S.; PETROSYAN, Yu.S.; PRONIN, V.I.

Coronary arteriography in experimental and clinical practice.
Grud.khir. 4 no.6:41-45 N-D'62. (MIRA 16:10)

1. Iz otdeleniya khirurgii sosudov (zav. - doktor meditsinskikh nauk Yu. Ye.Berezov) i rentgenovskogo otdeleniya (zav. - dotsent M.A.Ivanitskaya) Instituta serdechno-sosudistoy khirurgii (dir. prof. S.A.Kolesnikov, nauchnyy rukovoditel' - akademik A.N.Bakulev) AMN SSSR. Adres avtorov: Moskva, V-49, Leninskiy prospekt d.8, Institut serdechno-sosudistoy khirurgii AMN SSSR.
(ANGIOCARDIOGRAPHY)

PETROSYAN, Yu.S.; ZINGERMAN, L.S.; POKROVSKIY, A.V.; ANANIKYAN, P.P.

Transcutaneous selective angiography by the Seldinger technique in the diagnosis of cardiovascular diseases. Vest.khir. 90 no.2:57-63 F'63. (MIRA 16:7)

1. Iz rentgenovskogo otdeleniya (zav.- dotsent M.A.Ivanitskaya) i otdeleniya khirurgii sosudov (zav. - doktor med. nauk Yu.Ye. Perezov) Instituta serdechno-sosudistoy khirurgii (dir. - prof. S.A.Kolesnikov, nauchnyy rukovoditel' - akademik A.N.Bakulev) AMN SSSR. Adres avtorov: Moskva, Leninskiy pr., d.8, Institut serdechno-sosudistoy khirurgii AMN SSSR.
(ANGIOGRAPHY) (CARDIAC CATHETERIZATION)

ZINGERMAN, L.S.; KOGAN, B.M.; KURILOVICH, Ya.B.

Experimental data on the evaluation of coronarography. Eksp. khir. i anest. 8 no.3:29-33 My-Je'63 (MIRA 17:1)

1. Iz Instituta serdechno-sosudistoy khirurgii (dir. - prof. S.A. Kolesnikov, nauchnyy rukovoditel' - akademik A.N.Bikulev) AMN SSSR.

ZINGERMAN, L.S.; KOGAN, B.M.

Changes in the electroencephalography in coronarography.

Kardiologiya no.1:69-72 '64.

(MIRA 17:10)

1. Laboratoriya funktsional'noy diagnostiki (zav.- kand. med. nauk G.G. Gel'shteyn) i rentgenovskoye otdeleniye (zav.- dotsent M.A. Ivanitskaya) Instituta serdechno-sosudistoy khirurgii (dir.- prof. S.A. Kolesnikov, nauchnyy rukovoditel'- akademik M.N. Bakulev) AMN SSSR, Moskva.

BEREZOV, Yu.Ye., prof.; PETROSYAN, Yu.S.; ZINGERMAN, L.S.

Coronary arteriography as a method of preoperative diagnosis of
chronic coronary insufficiency. Khirurgiia 40 no.1:46-51 Ja '64.
(MIRA 17:11)

1. Otdeleniye khirurgii sosudov (zav. - prof. Yu.Ye. Berezov) i
rentgenovskoye otdeleniye (zav. - doktor med. nauk M.A. Ivanitskaya)
Instituta serdechno-sosudistoy khirurgii (dir. - prof. S.A. Kolesni-
kov, nauchnyy rukovoditel' akademik A.N. Bakulev) AMN SSSR, Moskva.

ZINGERMAN, L.S.; PRONIN, V.I. (Moskva)

Coronary endarterectomy in chronic coronary insufficiency.
Grud. khir. 6 no.1:97-99 Ja-F '64. (MIHA 18:11)

1. Adres avtorov: Mos'va, V-49, Leninskiy prospekt, dom 8,
Institut serdechno-sosudistoy khirurgii.

ALEKSANDROVSKIY, G.G., inzh.; ZIMICHEV, Yu.I., inzh.; ZINGERMAN, I.I., inzh.

Device for measuring the eccentricity of steam turbine rotors.
Energomashinostroenie li no.4:42-43 Ap '65. (MIRA 18:6)

ZINGERMAN, M.I., kand.med. nauk (Khabarovsk)

Recognition of cryptogenic brain abscesses in patients treated
with sulfamides and antibiotics. Vop. neirokhir. 27 no. 1: 59
Jl-Ag'63 (MIPA 17:2)

ZINGERMAN, M.I.; SHARIN, V.H. (Khabarovsk)

Multicameral echinococcosis of the brain. Vop. neirokhir. 18 no. 4:
59-60 JI-Ag '54. (MIRA 7:10)

(BRAIN, diseases,
*echinococcosis)
(ECHINOCOCCOSIS,
*brain)

ZINGERMAN, M.I. (Khabarovsk)

Etiology and pathogenesis of Adie syndrome; clinical-chronaximetric analysis. Zhur. nevr. i psikh. 59 no.1:14-17 '59. (MIRA 12:3)

(ADIE SYNDROME, case reports,
clin. & chronaximetric aspects (Rus))

ZINGERMAN, M.I.; SHARIN, V.N. (Khabarovsk)

Clinical aspects and therapy of arachnitis of the posterior cranial
fossa. Vop.neirokhir. 22 no.6:41 N-D '58. (MIRA 12:2)
(ARACHNOID, dis.
arachnitis of posterior cranial fossa (Rus))

YAGOLA, G.K.; ZINGERMAN, V.I.; GROBOVITSKIY, M.F.; SEPETYY, V.N.

Testing samples of hard-magnetic materials subjected to pulsed magnetization. Izv. tekhn. no.1:40-43 Ja '65. (MIRA 18:4)

ZINGERMAN, V.I.

Electromagnetic with a uniform stable magnetic field for
measurements. Izv.tekh. no.2:19-23 F '64. (MIRA 17:4)

ZINGERMAN, V.I.; SEPETYY, V.N.; YAGOLA, G.K.

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Determining the absolute gyromagnetic ratio of the proton in high
magnetic fields. Trudy inst.Kom.stand., ser i izm.prib. no.72:17-
38 '63. (MIRA 16:9)

1. Khar'kovskiy gosudarstvennyy institut mer i izmeritel'nykh pri-
borov.

(Magnetic measurements)

SEPETY, V.N.; YAGOLA, G.K.; ZINGERMAN, V.I.

Changes in magnetic induction in the magnet gap caused by the
introduction of weak-magnetic parts of measuring devices into
the gap. Izv. tekhn. no. 10:47-52 0 '63. (MIRA 16:12)

YAGOLA, G.K.; LIZOGUB, M.S.; ZINGERMAN, V.I.; BOGATYREV, Ye.Ye.

A nuclear meter for measuring strong magnetic fields. Izv.tekh.
no.6:9-12 H-D '55. (MLBA 9:3)

(Magnetic fields--Measurement) (Nuclear magnetic moments)
(Electronic measurements)

ACCESSION NR AT3013126

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AUTHOR Zingerman, V. I. Sepety'y, V. N. Yagola, G. K.

TITLE Absolute determination of the gyromagnetic ratio of the proton in strong magnetic fields

SOURCE USSR. Komitet standartov, mer 1 izmeritel'ny*kh priborov. Trudy* institutov Komiteta, no. 72, 1963, 17-38

TOPIC TAGS gyromagnetic ratio, proton gyromagnetic ratio, gyromagnetic ratio measurement, nickel sulfate solution

ABSTRACT Apparatus consisting of an electromagnetic with homogeneous magnetic field stabilized by proton magnetic resonance, a meter for the measurement of the distribution of the magnetic field, a magnetic balance, and apparatus for measuring the current in the coil of the balance have been developed at KhGIMIP. It is claimed that the procedure and the apparatus are better than in similar equipment developed by the National Bureau of Standards and the Physicotechnical Institute of West Germany, and that the error analysis is more comprehensive. The apparatus was used to determine the proton gyromagnetic

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ACCESSION NR AT3013126

ratio in an aqueous solution of $\text{NiSO}_4 \cdot 7\text{H}_2\text{O}$ (concentration 0.1 M). Several series of measurements were made at two values of magnetic inductions (approximately 0.24 Wb/m^2 at $f_0 \sim 10 \text{ Mcs}$ and approximately 0.47 Wb/m^2 , $f_0 \sim 20 \text{ Mcs}$) yielded for the proton gyromagnetic ratio without the diamagnetic correction) a value $\gamma = 2.67505 \times 10^8 (\text{Wb/m}^2)^{-1} \text{ sec}^{-1}$, with a maximum error of $\pm 0.00005 \times 10^8 (\text{Wb/m}^2)^{-1} \text{ sec}^{-1}$. The coils of the magnetic balance and the pole pieces of the electromagnetic balance and the pole pieces of the electromagnetic were made by A. A. Vetvinskiy, the coil dimensions were measured by R. V. Dybskiy and E. P. Yanushkevich. M. S. Lizogub and Ye. G. Verbenko participated in the development of the magnetic balance and Ye. Ye. Bogatyrev and Ya. A. Zil'bershteyn participated in the preparation of the experimental electronic apparatus. Orig. art. has 8 figures, 10 formulas, and 7 tables.

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ZINGERMAN, V.I.

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Vassoumyy nauchno-issledovatel'skiy institut metrologii imeni
D.I. Mendeleeva
Referaty nauchno-issledovatel'skiy rabot; sbornik No.2 (Scientific
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Standartgiz, 1958. 139 p. 1,000 copies printed.
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Ed.: S. V. Reshetina; Tech. Ed.: M. A. Kondrat'yeva.
PURPOSE: These reports are intended for scientists, researchers,
and engineers engaged in developing standards, measures, and
gags for the various industries.

COVERAGE: The volume contains 128 reports on standards of measure-
ment and control. The reports were prepared by scientists of
institutes of the Komitet standartov, ser 1 izmeritel'nykh
priborov pri Sovete Ministrov SSSR (Commission on Standards,
Measures, and Measuring Instruments under the USSR Council of
Ministers). The participating institutes are: VNIIM -
Vassoumyy nauchno-issledovatel'skiy metrologii imeni D.I.
Mendeleeva (All-Union Scientific Research Institute of Me-
tology Imeni D.I. Mendeleeva) in Leningrad; Sverdlovsk branch
of this institute; VNIIF - Vassoumyy nauchno-issledovatel'skiy
institut standartov, ser 1 izmeritel'nykh priborov
(All-Union Scientific Research Institute of the Commission
on Standards, Measures, and Measuring Instruments) in
Moscow; VNIIF - Vassoumyy nauchno-issledovatel'skiy institut
izmeritel'nykh priborov (Moscow State Institute of Measures
and Measuring Instruments) October 1, 1955; VNIIF -
Vassoumyy nauchno-issledovatel'skiy institut fiziko-tekhn-
icheskikh i radiotekhnicheskikh izmereniy (All-Union Scientific
Research Institute of Physicotechnical and Radio-engineering
Measurements) in Moscow; KNDIMF - Khar'kovskiy gosudarstvennyy
institut ser 1 izmeritel'nykh priborov (Char'kov State Institute
of Measures and Measuring Instruments); and KNDIMF - Khar'kov-
skiy gosudarstvennyy institut ser 1 izmeritel'nykh priborov
(Kharkov State Institute of Measures and Measuring Instru-
ments). No personalities are mentioned. There are no references.

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YAGOLA, G.K.; ZINGERMAN, V.I.; SEPETYY, V.N.; Prinimali uchastiye:
VETVINSKIY, A.A.; BOGATYREV, Ye.Ye.

Determining the value of the gyromagnetic ratio of protons.
Izv.tekh. no.5:24-29 My '62. (MIRA 19:6)
(Protons) (Magnetic measurements)

ZINGERMAN, V.I.; SEPETYY, V.N.; YAGOLA, G.K.

Instrument generator with phase-sensitive voltmeter for measuring
the stray fields of magnets. Trudy inst. kom. stand. mer i izm. prib.
no.67:89-93 '62. (MIRA 17:11)

1. Khar'kovskiy gosudarstvennyy institut mer i izmeritel'nykh priborov.

ZINGERMAN, V.I.; YAGOLA, G.K.

Interpole inserts for obtaining uniform magnetic fields in instrument
magnets. Trudy inst. Kom. stand. mer i izm. prib. no. 67:94-99 '62.
(MIRA 17:11)

1. Khar'kovskiy gosudarstvennyy institut mer i izmeritel'nykh pri-
borov.

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SOURCE CODE: UR/0058/66/000/006/D066/D066

AUTHOR: Zil'bershteyn, Ya. A.; Zingerman, V. I.

TITLE: Nuclear meter of magnetic field intensity with automatic frequency control and miniature probes

SOURCE: Ref. zh. Fizika, Abs. 6D543

REF SOURCE: Tr. in-tov Gos. kom-ta standartov, mer i izmerit. priborov SSSR. vyp. 79(139), 1965, 56-64

TOPIC TAGS: nmr meter, automatic frequency control, miniature probe, autodyne detector, magnetic field meter/IMP-3 meter

ABSTRACT: A description is given of an IMP-3-type NMR magnetic-field meter intended for use both as an instrument for checking other NMR meters and as a high-accuracy operating instrument. Measurement limits are within 40--128 ka/m and the error is 0.002--0.004%. The autodyne detector uses a Pound-Knight circuit. The frequency band is divided into 5 subbands (1.85--3.8; 3.7--7.6; 7.4--16.3; 14.3--30.4; and 29.7--44.7 mc). Use is made of NMR signals from H^1 and Li^7 . The instrument is equipped with probes 4 mm in diameter, either with or

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